

## REMARKS/ARGUMENTS

## Amendments

Claim 1 has been amended to include all the limitations of claim 5. As a result, claim 1 now requires that the crystalline polymer in the first polymeric composition is a side chain crystalline polymer having a  $T_p$  of  $-20$  to  $40^{\circ}\text{C}$ , and that the value of  $k$  in the expression defining the value of  $(T_p - T_o)$  is 16. Independent claim 12 has likewise been restricted to such side chain crystalline polymers, and has been further limited to the limitation of claim 13, i.e. to require that the volume expansion of the first polymeric composition is at least 5 times the volume expansion of the second composition. Consequential amendments have been made to claims 4-7, 13, 14 and 17.

It is submitted that these amendments can properly be made at this stage, since the amendments (which merely limit the independent claims to features which were previously the subject of dependent claims) raise no new issues and put the claims in better condition for any appeal that may be necessary.

The Rejections under 35 USC 102

Applicant respectfully traverses the rejections under 35 USC 102, insofar as they are applicable to the amended claims. As noted above, all the claims now require that the first polymeric composition should comprise a side chain crystalline polymer having a  $T_p$  of  $-20$  to  $40^{\circ}\text{C}$  and the specified value of  $(T_p - T_o)$ . Neither of the references discloses any side chain crystalline polymer.

For the sake of completeness, attached hereto are

- (a) columns 10-12 of US Patent No. 5,387,450 (which is incorporated by reference on page 10, line 28, of this application), which provide information about side chain crystalline polymers, and
- (b) the definition of paraffin wax to be found on Wikipedia.

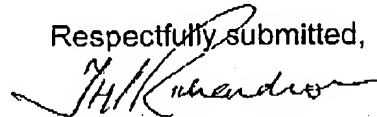
These documents will make it clear that

- (i) neither the paraffin wax nor the polyethylene referred to in JP8 is a side chain crystalline polymer, and
- (ii) none of the polymers disclosed in Clark is a side chain crystalline polymer.

### CONCLUSION

It is believed that this application is now in condition for allowance, and applicant respectfully requests that a timely Notice of Allowance be issued in this case. If, however, there are any outstanding issues that could usefully be discussed by telephone, the Examiner is asked to call the undersigned.

Respectfully submitted,



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Paraffin - Wikipedia, the free encyclopedia

# Paraffin

From Wikipedia, the free encyclopedia

**Paraffin** is a common name for a group of alkane hydrocarbons with the general formula  $C_nH_{2n+2}$ , where  $n$  is greater than about 20, discovered by Carl Reichenbach. It is distinct from the fuel known in Britain as *paraffin oil* or just *paraffin*, which is called kerosene in American English. Usage of the term varies in other countries, leading to confusion about which substance is being referred to. The solid forms of paraffin are called *paraffin wax*. *Paraffin* is also a technical name for an alkane in general, but in most cases it refers specifically to a linear, or *normal* alkane — whereas branched, or *iso*alkanes are also called *isoparaffins*. The name is derived from the Latin *parum* (= barely) + *affinis* with the meaning here of "lacking affinity", or "lacking reactivity").

## Contents

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## Physical and chemical properties

It is mostly found as a white, odorless, tasteless, waxy solid, with a typical melting point between about 47 °C and 64 °C. It is insoluble in water, but soluble in ether, benzene, and certain esters. Paraffin is unaffected by most common chemical reagents, but burns readily.

Pure paraffin is an extremely good electrical insulator, with an electrical resistivity of  $10^{17}$  ohm meter. This is better than nearly all other materials except some plastics (notably teflon).

Paraffin wax ( $C_{25}H_{52}$ ) is an excellent material to store heat, and has a typical heat capacity of .6 BTU/lb F to .66 BTU/lb F and a heat of fusion of 90-95 BTU/lb.

In industrial uses, it is often usefull to modify the crystal properties of the paraffin wax, typically by adding branching to the existing carbon backbone chain. The modification is usually done with additives, such as EVA copolymers, microcrystalline wax[1], or polyethylene materials, such as C-16. The branched properties result in a modified paraffin with a higher viscosity, smaller crystalline structure, and modified functional properties.

## Liquid paraffin

Liquid paraffin has a number of names, including nujol, mineral spirits, adepsine oil, alboline, glymol, liquid paraffin, medicinal paraffin, saxol, or USP mineral oil. It is often used in infrared spectroscopy, as it has a relatively uncomplicated IR spectrum. When the sample to be tested is made into a mull (a very thick solution), liquid paraffin is added so it can be spread on the disks to be tested. Liquid paraffin is also excellent for helping bowel movement in persons suffering chronic constipation.

Paraffin - Wikipedia, the free encyclopedia

It is also used as the fuel in Portable stoves because of its steady burning.

## Uses

- Candle making
- Coatings for waxed paper or cloth.
- Food-grade paraffin wax
  - is used in some candies to make them look shiny. Although edible, it is nondigestible; it passes right through the body without being broken down.
  - Non-food grade paraffin wax can contain oils and other impurities which may be toxic or harmful.
  - Magic Shell
  - Coating for many kinds of hard cheese, like Edam cheese.
  - Sealing jars, cans, and bottles.
- A key component in wax used for investment casting.
- As anti-caking, moisture repellent, and dustbinding coatings for fertilizers.
- Preparing specimens for histology.
- Solid propellant for hybrid rocket motors.
- In dermatology, as an emollient (moisturiser).
- Surfing, for grip on surfboards as a component of surfwax.
- The primary component of glide wax, used on skis and snowboards.
- For use on handrails and cement ledges to dramatically reduce friction for rolling, otherwise known as aggressive in-line skating.
- Microwax[2] as a food additive, a glazing agent with E number E905.
- The paraffin test is used in forensics to detect nitrates and nitrites on the hand of a shooting suspect.
- A fire performance fuel.
- Blends of paraffin and micro waxes in rubber compounds as anti-ozonant agent, to prevent cracking of the rubber. The antiozonant waxes can today be produced from synthetic waxes, FT wax, and Fischer Tropsch wax.

Thermostats and actuators, as a temperature medium for activating such devices[3]

- "Potting" guitar pickups, which reduce microphonic feedback caused from the subtle movements of the pole pieces
- Paraffin, being rich in hydrogen, is used in some experiments with neutrons.

Impure mixtures of mostly paraffin wax are used in wax baths for beauty and therapy purposes.

Paraffin wax is not used much to make original models for casting, as it is relatively brittle at room temperature and usually cannot be cold-carved without excessive chipping and breaking. Soft, pliable waxes such as beeswax are preferred for modeling. For casting of metal and other materials, "investment casting waxes" are used, which use the paraffin in combination with several other materials to obtain the desired properties.

Paraffin Wax is also the wax used by Crayola, and is a thickening agent in many Paintballs

## See also

Paraffin - Wikipedia, the free encyclopedia

- Paraffin oil
- Mineral oil
- Microcrystalline wax

## References

E numbers	[hide]
Colours (E100–199) • Preservatives (E200–299) • Antioxidants & Acidity regulators (E300–399) • Thickeners, stabilisers & emulsifiers (E400–499) • pH regulators & anti-caking agents (E500–599) • Flavour enhancers (E600–699) • Miscellaneous (E900–999) • Additional chemicals (E1100–1599)	
Waxes (E900–909) • Synthetic glazes (E910–919) • Improving agents (E920–929) • Packaging gases (E930–949) • Sweeteners (E950–969) • Foaming agents (E990–999)	
Dimethyl polysiloxane (E900) • Beeswax (E901) • Candelilla wax (E902) • Carnauba wax (E903) • Shellac (E904) • Paraffins (E905) • Mineral oil (E905a) • Vaseline (E905b) • Microcrystalline wax (E905c) • Gum benzoic (E906) • Crystalline wax (E907) • Rice bran wax (E908)	

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hesive composition can be used on many types of substrates, e.g., metal, glass, plastic, and the like.

The term "tack" as used hereinabove is intended to designate the tacky or sticky nature of the adhesive compositions. Tack can generally be determined by what is referred to as the thumb test in which the thumb makes rapid and reversible contact with the surface being considered to determine the tacky or sticky nature of the surface. A substantially more accurate and reproducible test for tack is designated D2979 by the American Society for Testing and Materials. In this test which employs a Polyken™ instrument, values are given in grams of force required to remove the end of a stainless steel rod, 5.0 mm in diameter, from the surface of an adhesive coated assembly. Prior to the removal, the rod approaches the surface at a speed of 10 mm per second and makes contact with the adhesive for a prescribed period of time. The actual time of contact is variable and discretionary. (In obtaining the values reported herein, a half-second dwell time was used.) The units of measure are given in grams/cm/sec and are the ones to which a plurality of the tack values used in the present specification refer. The Tack Rolling Ball Test (TRBT) designated as D3121 by the above Society and PSTC-6 (revision 8/85) by the Pressure Sensitive Tape Council is also ideally suited for accurately and reproducibly measuring tack over wide temperature ranges. This test is described in the Experimental section of this application, below.

The terms "tack" and "tacky" are qualitative. The tack of an adhesive film coating is affected by its thickness, especially when the coating is less than about 0.005 in thickness. Generally, tack increases linearly with thickness. In order to make a more quantitative evaluation between different samples made with different coating thicknesses, tack values can be (and have been in this application) normalized to values which would be expected had that sample been cast or otherwise applied at a thickness of 0.001 inch.

The terms relating to the normalized value properties of an adhesive coating obtained by either the PKI or TRBT tack determination method can be verbally described as "substantially nontacky" "slightly tacky" and "tacky". These terms are intended to relate to approximate values, respectively: (1) a tack value which is the minimum limit of the instrument or less than about 25 g.cm/sec of force; (2) a tack value between that described in (1) to about 100 g.cm/sec of force; and (3) a tack of at least about 100 g.cm/sec of force.

The term "bond strength" between an adhesive coated article and the substrate to which it is joined is defined as the force required to separate those components.

The term "peel" as used hereinabove is intended to define the bond strength between an adhesive coated article and the substrate to which it's joined when those components are separated at a rate of 12 inches/min and where the angle between separated components approximates 180°. The peel strength of an adhesive film coating is also affected by its thickness, especially when the coating is less than 0.005 inches thick. Generally, peel strength of any particular adhesive increases linearly with the square root of thickness. In order to make a more quantitative evaluation between different samples made with different coating thicknesses, peel strength values can be (and have been in this application) normalized to values which would be expected

had that sample been cast or otherwise applied at a thickness of 0.001 inch.

The polymer in each of Embodiments (I), (II) and (III), (IV) and (V) is preferably a crystallizable polymer or a functional equivalent of a crystallizable polymer having a weight average molecular weight in the range of about 20,000 to 2,300,000 Daltons, typically 100,000 to 1,300,000 Daltons, most typically 250,000 to 1,000,000 Daltons. By polymers which are "functionally equivalent" to crystallizable polymers for purposes of the present invention, applicant intends to include polymers which exhibit the temperature-dependent adhesion properties described above. Crystallizable polymers which may be used in the adhesive composition include both side-chain crystallizable and main-chain crystallizable polymers, the difference being that the former class of compounds contain crystallizable side-chain moieties, and the latter class are rendered crystallizable by their backbone structure. Depending on the embodiment, the polymer selected for incorporation into the adhesive assembly will comprise different monomers which provide the composition with the desired phase transition temperature, bond strength, and tack. The adhesive composition may also be formulated so as to contain blends of two or more different polymers as described herein. An assembly of the invention such as a medical tape may have different adhesives coated thereon in two or more layers over each other and may be coated continuously or sporadically in regular or irregular patterns.

Side-chain crystallizable polymers, sometimes called "comb-like" polymers, are well-known and available commercially. These polymers are reviewed in *J. Polym. Sci.: Macromol. Rev.* 8:117-253 (1974), the disclosure of which is hereby incorporated by reference. In general, these polymers contain monomer units X of the formula:



wherein M is a backbone atom, S is a spacer unit and C is a crystallizable group. These polymers generally have a heat of fusion (WH) of at least about 20 Joules/g, preferably at least about 40 Joules/g. The polymers will contain 50 to 100 wt. % monomer units represented by "X". If the polymer contains less than 100% X, it will in addition contain monomer units which may be represented by "Y" or "Z" or both wherein Y is any polar or nonpolar monomer or mixture of polar or nonpolar monomers capable of polymerizing with X and/or Z, and wherein Z is a polar monomer or mixture of polar monomers. These polar monomers—e.g., polyoxyalkylenes, acrylates including hydroxyethylacrylate, acrylamides and methacrylamides—will typically increase adhesion to most substrates. If the polar species "Z" is acrylic acid, it is preferred that it comprise about 1-10 wt. % of the polymer.

The backbone of the polymer (defined by "M") may be any organic structure (aliphatic or aromatic hydrocarbon, ester, ether, amide, etc.) or an inorganic structure (sulfide, phosphazine, silicone, etc.), and may include spacer linkages which can be any suitable organic or inorganic unit, for example ester, amide, hydrocarbon, phenyl, ether, or ionic salt (e.g., a carboxyl-alkyl

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ammonium or sulphonium or phosphonium ion pair or other known ionic salt pair).

The side-chain (defined by "S" and "C") may be aliphatic or aromatic or a combination of aliphatic and aromatic, but must be capable of entering into a crystalline state. Common examples are: linear aliphatic side-chains of at least 10 carbon atoms, e.g., C<sub>14</sub>-C<sub>22</sub> acrylates or methacrylates, acrylamides or methacrylamides, vinyl ethers or esters, siloxanes or alpha olefins; fluorinated aliphatic side chains of at least 6 carbons; and p-alkyl styrene side chains wherein the alkyl is of 8 to 24 carbon atoms.

The length of the side-chain moiety is usually greater than 5 times the distance between side-chains in the case of acrylates, methacrylates, vinyl esters, acrylamides, methacrylamides, vinyl ethers and alpha olefins. In the extreme case of a fluoroacrylate alternate copolymer with butadiene, the side-chain can be as little as two times the length as the distance between the branches. In any case, the side-chain units should make up greater than 50% of the volume of the polymer, preferably greater than 65% of the volume.

Specific examples of side-chain crystallizable monomers are the acrylate, fluoroacrylate, methacrylate and vinyl ester polymers described in *J. Poly. Sci.* 10:3347 (1972); *J. Poly. Sci.* 10:1657 (1972); *J. Poly. Sci.* 9:3367 (1971); *J. Poly. Sci.* 9:3349 (1971); *J. Poly. Sci.* 9:1835 (1971); *J.A.C.S.* 76:6280 (1954); *J. Poly. Sci.* 7:3053 (1969); *Polymer J.* 17:991 (1985), corresponding acrylamides, substituted acrylamide and malcimine polymers (*J. Poly. Sci.: Polym. Physics Ed.* 11:2197 (1980); polyalphaolefin polymers such as those described in *J. Poly. Sci.: Macromol. Rev.* 8:117-253 (1974) and *Macromolecules* 13:12 (1980), polyalkyl vinyl ethers, polyalkylethylene oxides such as those described in *Macromolecules* 13:15 (1980), alkylphos phazene polymers, polyamino acids such as those described in *Polym. Sci. USSR* 21:241, *Macromolecules* 18:2141, polyisocyanates such as those described in *Macromolecules* 12:94 (1979), polyurethanes made by reacting amine- or alcohol-containing monomers with long-chain alkyl isocyanates, polyesters and polyethers, polysiloxanes and polysilanes such as those described in *Macromolecules* 19:611 (1986), and p-alkylstyrene polymers such as those described in *J.A.C.S.* 75:3326 (1953) and *J. Poly. Sci.* 60:19 (1962).

Of specific utility are polymers which are both relatively polar and capable of crystallization, but wherein the crystallizing portion is not affected by moisture. For example, incorporation of polyoxyethylene, polyoxypropylene, polyoxybutylene or copolyoxyalkylene units in the polymer will make the polymer more polar, improving adhesion to moist skin.

Hydrophilic monomers are beneficially added to the polymer if it is desired to increase the MVTR properties of the adhesive. Commonly used hydrophilic comonomers include acrylic acid, acrylamide, hydroxy alkyl (meth)acrylates such as hydroxy ethyl acrylate, hydroxy ethyl methacrylate and hydroxy butyl acrylate, alkoxy (meth)acrylates such as ethoxy ethyl acrylate, ethoxy ethoxy ethylacrylate, ethyltriglycol methacrylate, 3-methoxy butylacrylate and the like. A preferred class of high MVTR inducing monomers are derivatives of polyethylene glycol of with molecular weights ranging from 50 to 5,000. Commonly these units may be incorporated either into the backbone or as pendant groups.

Moisture vapor transmission rates and/or absorptive properties of the adhesive may be modified by the in-

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corporation of soluble or insoluble hydrophilic materials, for example by addition of carboxymethyl cellulose, guar gum, carragean, cellulose based or synthetic fibers and the like.

In a particularly preferred embodiment herein, in the above structure, —C is selected from the group consisting of —(CH<sub>2</sub>)<sub>n</sub>—CH<sub>3</sub> and —(CF<sub>2</sub>)<sub>n</sub>—CF<sub>2</sub>H, where n is an integer in the range of 8 to 20 inclusive, —S— is selected from the group consisting of —O—, —CH<sub>2</sub>—, —(CO)—, —O(CO)— and —NR— where R is hydrogen or lower alkyl (1-6C), and —M— is —[(CH<sub>2</sub>)<sub>m</sub>—CH]<sub>n</sub>— where m is 0 to 2.

Typical "Y" units include linear or branched alkyl or aryl acrylates or methacrylates, alpha olefins, linear or branched alkyl vinyl ether or vinyl esters, maleic esters or itaconic acid esters, acrylamides, styrenes or substituted styrenes, acrylic acid, methacrylic acid and hydrophilic monomers as detailed in W084/0397, cited supra.

In addition to the above-described monomer units "M-S-C" monomer structures given by



may in addition, or in the alternative, be present in the polymer. "D" is a hydrophilic polyether chain such as a polyoxyalkylene chain (e.g., polyoxyethylene) which, in contrast to "C" may or may not be crystallizable "D" preferably has a molecular weight higher than about 100 Daltons.

It is important in the case of polyolefins, which can exist in a plurality of tactic forms, that in order to effect the sharpness of transition between tacky and nontacky states the tacticity of the polymer must be carefully selected. The polymer can be present in a singular configuration, i.e., either atactic, syndiotactic or isotactic, but not in a mixture of tacticities unless their melting points opportunistically coincide. Having a mixture of various tacticopolymers with different melting points will broaden the transition and cause the resultant polymer to exhibit sluggish adhesive property changes over a narrow temperature range.

Preferred main-chain crystallizable polymers include water-insoluble polyalkylene oxides, lower alkyl polyesters and polytetrahydrofuran.

The crystallizable polymer, whether side-chain or main-chain crystallizable, may or may not be cross-linked. Cross-linking the adhesive composition as well as employing high molecular weight polymers will, in general, result in a material that exhibits decreased melt flow and greater cohesive strength than non-cross-linked and low molecular weight materials. Because the adhesive composition may be used at temperatures above the melting point of the polymer, low melt flow is desirable so that the adhesive will not migrate, flow or transfer to the substrate surface (i.e., in contrast to conventional "hot-melt" adhesives). Adhesive compositions with sufficient cohesive strength to prevent cohesive failure is thus desirable. Low melt flow and suitable cohesive strength may be achieved by other means such as the addition of suitable comonomers (e.g., high Tg monomers), by the use of block copolymerization or other art-known methods, or the inducement of cross-